

Non-Linear Animation For Production

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What is Non-Linear Animation (NLA) ?

- (Definition is vendor-dependent :-)
 - ...but will try and generalise.....
1. Non-destructive retiming, sequencing and blending of reusable multi-type motion snippets
 2. Intuitive and familiar UI (NLE-type) for editing
 3. Retargeting of motion, libraries of motion, layering effects and generating compound motions

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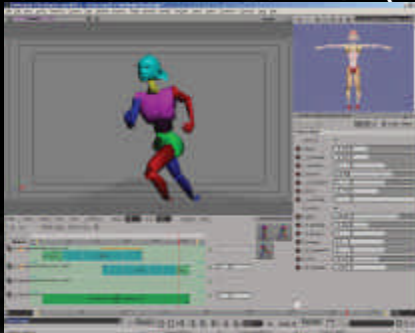
Whose software incorporates NLA? (incomplete list)

- **Softimage** (XSI's Animation Mixer)
- **Kaydara** (FilmBox)
- **Alias|Wavefront** (Maya's Trax)
- **Hash** (Animation Master)
- **Lightwave** (LW7's Motion Mixer)
- **Winged Edge** (Mirai)
- **Improv Technologies**
- + other systems detailing with motion abstraction
 - Side Effects (Houdini), Discreet (Character Studio's Motion Flow), Softimage (RTK), etc...

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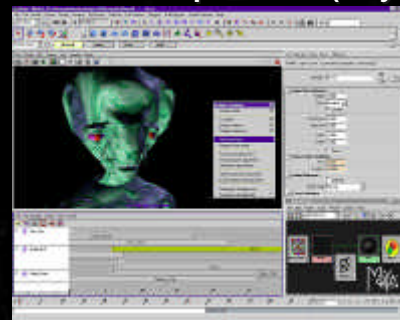
What does an NLA look like ? (XSI)



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...another subsequent one (Maya)



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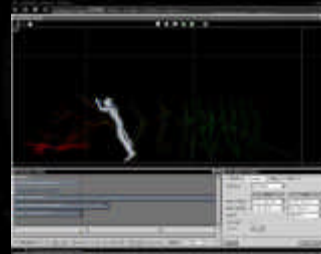
...and another (*Lightwave 7*)



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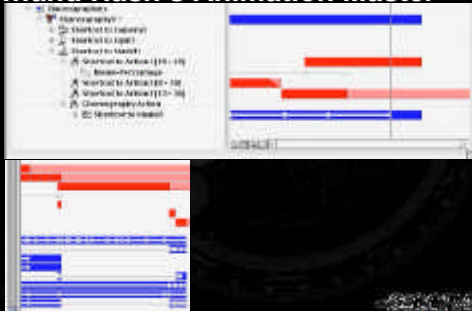
...Winged Edge's *Mirai* in action



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...and Hash's Animation Master



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Evolution of animation techniques

- Per-frame-animation
- Function curves
- Dopesheet
- Animation sequencing
- Non-Linear Animation (retiming arbitrary motion snippets, blending, re-use, editing..)

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Elements of NLA

- Intuitive (NLE-type) interface for manipulating clips from sources containing e.g. poses, shapes etc
 - Retiming (offsetting, scaling, cycling, warping)
 - Transitioning (clip-to-clip)
 - Blending (arbitrary blends of multiple clips)
 - Compounding behaviour & layering of effects atop motion
- Non-destructive use of motion clips
- Ability to retarget motion sources

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NLA and Shape Animation/Audio/Images

- Workflows for NLA systems informed by
 - Video and film editing NLE systems
 - Audio (samples, clips) processing systems
 - Experience gained with shape animation
 - Transitioning shape keys
 - Mixing shape keys

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Motion. Audio. Shapes Etc...



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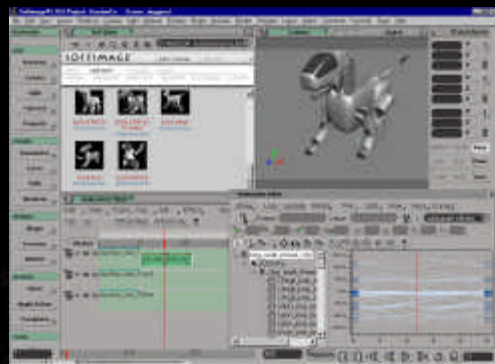
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Basic concepts of NLA

- **Sources**
 - Reusable containers for abstract motion (individual poses, fcurves, expressions, constraints, shapes)
 - Can exist without being connected, and transported between characters
- **Clips**
 - An instantiation of a source to drive something in the scene (pose, shape, any animatable parameter)

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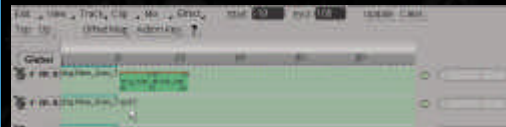


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Basic concepts of NLA - Instancing

- **Source instanced to drive a character**
 - Clip contains some animation curves that were authored 'traditionally'
 - Instantiation connects the source to drive the character (dog)

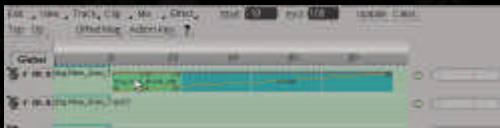


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Basic concepts of NLA - Retiming

- Clip's timing can be manipulated without altering or destroying the data contents
 - Move/scale/offset
 - Cycle/Bouncing to repeat motion
 - Motion Warping (to control relative speed of motion within clip)

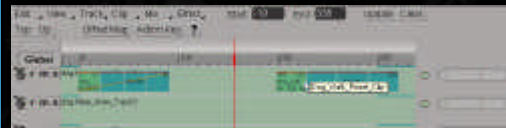


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Basic concepts of NLA - Source Re-use

- **Original clip copied to give two versions of same underlying motion**
 - Clips can be copied to drive other characters as well as the one in which they were originally authored

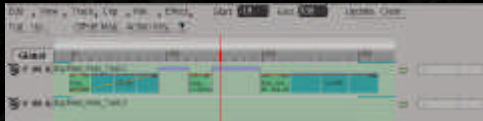


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Basic concepts of NLA - Sequencing/Transitioning

- Added a new clip (static pose)
- First clip is eased into second, which eases into third
 - Note : Data in the transition region is synthesized/generated
 - Lots of tricks to try and blend smoothly and create good generated motion (see Seth's talk)



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Basic concepts of NLA - Mixing (motion compositing)

- A new clip is added that contains another keyed motion (wave)
 - This clip is instantiated to overlap the rest of the motion and blended against it
- Arbitrary layers of motion inside different clips can thus be mixed



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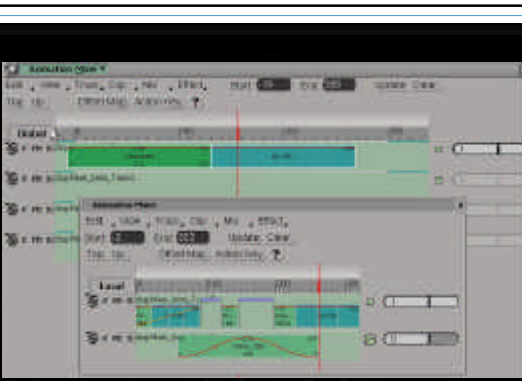
Basic concepts of NLA - "Compounding"

- Non-destructively creating a new clip based on the result of the mix and sequence of originals
- This new clip can be retimed, mixed, reused etc just like a basic clip
- Contents remain intact, so can revert



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Advanced Non-Linear Animation

- Layering effects atop existing clips
 - Signal processing (e.g. control motion freq, equalization to match relative 'speed' of motion)
 - Motion warping/offsetting (to add secondary layer of motion without affecting original)
 - Intelligent blending (e.g. radial basis, quat orientation blends) to give good synthesized motion

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Advanced Non-Linear Animation

- Transportability and mapping between characters
- Authoring 'in place'
- Pose-to-pose
- Animation context, and being able to move back and forwards across the production pipeline

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Non-Linear Animation - Motion Capture Finishing Tool ?

- Combine/blend motion capture data with the work of character animators and storyboards
 - Basic mixing/sequencing mocap clips against animation/poses
 - Layering keyed motion atop existing clips
 - See SIGGRAPH97 Panel - Motion Capture vs Animation
- However - a good NLA system is in no way limited to motion capture or finishing

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Applications of Non-Linear Animation

- Motion re-use, retargeting, retiming and combination
- Ability to experiment creatively with motion regardless of it's source
- Productivity and creativity
 - Crowd work, secondary & hero characters
- Managing increasing complexity
- Pre-visualisation, storytelling

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NLA - what it is not

- Not a replacement for good, source animation
 - "Garbage in, garbage out"
- Not a replacement for animators
- Can't make bad ideas look good

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NLA - what it can be

- A tool to help animators, TDs, directors, editors :
 - Develop motion and character
 - Communicate visually
 - Merge motion from different origins
 - Tell stories

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Acknowledgements

- Softimage
 - R&D - Glen Fraser, Ronald Beirouti, Rejean Gagne, Christian Roy, Michael Gachet, Marie-Claude Frasson, Gareth Morgan, Olivier Ozoux, Mike Isner
 - Soft's field animators providing feedback
 - The many co-ops from who have worked with Soft
- All animators using the tools, who have helped define where we head as devs

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For further information...

- Check out <http://www.nonlinearanimation.com>
- Raf's article here : <http://www.anzovin.com/reviews/column8.html>
- Current Issue of 3D World magazine

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